The diet of Flying-foxes in the Sydney and Gosford areas of New South Wales, based on sighting reports 1986–1990

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INTRODUCTION

Flying-foxes are frequent visitors to urban locations throughout coastal Eastern Australia and the sounds made by foraging flying-foxes are an integral part of the night noise for millions of Australians. However, there was little attempt to encourage people to record the presence and behaviour of flying-foxes until 1986 when the Royal Zoological Society established BATWATCH. This programme has been extremely successful in obtaining community support in recording flying-foxes wherever they are heard or seen.

In this paper are recorded the sightings of foraging flying-foxes in two major areas; the city of Sydney and the nearby city of Gosford. The location of the focal mating site for both these areas is known, the Sydney site is at suburban Gordon and the Gosford site is at Matcham (Parry-Jones 1987).

A recent study (Parry-Jones and Augee 1991), in which the diet of the Matcham colony from 1986 to 1990 was investigated by dropping analysis, has shown that the most frequent food to be found in Grey-headed Flying-fox droppings from the Gosford area is pollen from the Myrtaceae, Proteaceae (especially *Banksia* spp. and *Grevillea robusta*), Lauraceae, and Fabaceae (almost entirely the introduced Coral Tree *Erythrina* sp.) Families. While the most common fruits represented were the native figs, both poplar and Grey Mangrove leaf were found in large amounts. However, due to the difficulties of distinguishing most of the pollen to species level, that study did not identify the specific sources of flying-fox food.

The reports submitted by Batwatchers provide valuable information on the types of trees in which flying-foxes have been sighted and when this information is combined with the information from dropping analysis, a complete description of the diet of flying-foxes is possible.

METHOD

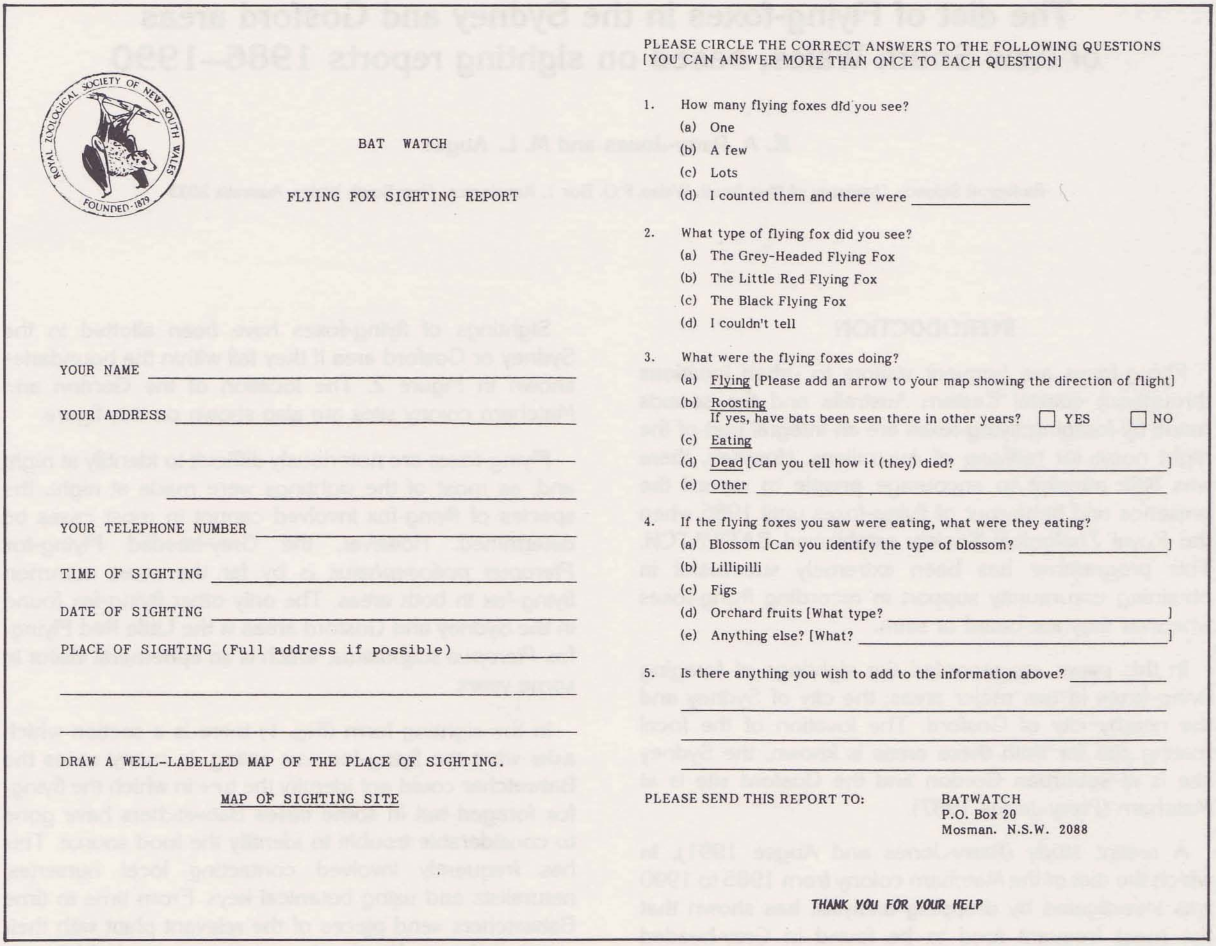
Figure 1 is the BATWATCH sighting form which is sent to Batwatchers.

Sightings of flying-foxes have been allotted to the Sydney or Gosford area if they fall within the boundaries shown in Figure 2. The location of the Gordon and Matcham colony sites are also shown on this figure.

Flying-foxes are notoriously difficult to identify at night and, as most of the sightings were made at night, the species of flying-fox involved cannot in most cases be determined. However, the Grey-headed Flying-fox *Pteropus poliocephalus* is by far the most common flying-fox in both areas. The only other flying-fox found in the Sydney and Gosford areas is the Little Red Flying-fox *Pteropus scapulatus,* which is an ephemeral visitor in some years.

In the sighting form (Fig. 1) there is a section which asks what the flying-fox was eating. In many cases the Batwatcher could not identify the tree in which the flying-fox foraged but in some cases Batwatchers have gone to considerable trouble to identify the food source. This has frequently involved contacting local nurseries, naturalists and using botanical keys. From time to time Batwatchers send pieces of the relevant plant with their sighting form. Mostly these are species which are frequently reported and are well known flying-fox foods, such as native fig or poplar leaf, however, there have been two infrequently reported foods sent in and these were identified as the fruits of *Hovenia dulcis* (Japanese Raisin), and flowers of *Liriodendron tulipifera* (Tuliptree), when referred to the Herbarium at the Sydney Botanic Gardens. The Tuliptree flower was interesting as there were bat bites at the base of the flower. Therefore a bat can obtain the nectar without coming into contact with the pollen on the anthers, making it unlikely that examination of pollen in the faecal material would show that this plant had been used as a food source.

Some infrequently reported food plants may be the result of misidentification by the Batwatcher and similarly the part of the plant eaten by the bats may be incorrectly identified, so the information reported in this paper should be treated with suitable caution. However, potential food sources which have been the subject of a number of reported sightings are likely to be of importance to flying-foxes.



ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES
FOUNDED 1879

BAT WATCH

FLYING FOX SIGHTING REPORT

YOUR NAME ______

YOUR ADDRESS ______

______

YOUR TELEPHONE NUMBER ______

TIME OF SIGHTING ______

DATE OF SIGHTING ______

PLACE OF SIGHTING (Full address if possible) ______

______

______

DRAW A WELL-LABELLED MAP OF THE PLACE OF SIGHTING.

MAP OF SIGHTING SITE

PLEASE CIRCLE THE CORRECT ANSWERS TO THE FOLLOWING QUESTIONS
[YOU CAN ANSWER MORE THAN ONCE TO EACH QUESTION]

1. How many flying foxes did you see?
   - (a) One
   - (b) A few
   - (c) Lots
   - (d) I counted them and there were ______

2. What type of flying fox did you see?
   - (a) The Grey-Headed Flying Fox
   - (b) The Little Red Flying Fox
   - (c) The Black Flying Fox
   - (d) I couldn't tell

3. What were the flying foxes doing?
   - (a) Flying [Please add an arrow to your map showing the direction of flight]
   - (b) Roosting
     If yes, have bats been seen there in other years? ☐ YES ☐ NO
   - (c) Eating
   - (d) Dead [Can you tell how it (they) died? ______]
   - (e) Other ______

4. If the flying foxes you saw were eating, what were they eating?
   - (a) Blossom [Can you identify the type of blossom? ______]
   - (b) Lillipilli
   - (c) Figs
   - (d) Orchard fruits [What type? ______]
   - (e) Anything else? [What? ______]

5. Is there anything you wish to add to the information above? ______

______

______

______

PLEASE SEND THIS REPORT TO:

BATWATCH
P.O. Box 20
Mosman. N.S.W. 2088

THANK YOU FOR YOUR HELP

Fig. 1. BATWATCH form used to report sightings of flying-foxes.

RESULTS

BATWATCH reports on foraging flying-foxes in the Gosford area and Sydney area have been collated and Table 1 (Gosford) and Table 2 (Sydney) list the range of trees in which flying-foxes have been observed feeding.

DISCUSSION

The majority of sightings from Sydney and Gosford are very similar, reflecting the similarity of the vegetation in these two adjacent areas. Plants from the Myrtaceae and Proteaceae are the subject of most reports of foraging flying-foxes while native figs are the most frequent fruit reported as providing food for flying-foxes.

More species are listed for Sydney (Table 2) than for Gosford (Table 1). This difference is easily explained for winter blossoming species which are found in both areas, such as *Eucalyptus sideroxylon* in Table 2. The Gosford colony is only resident at the Matcham site during the warmer months of the year (Parry-Jones and Augee 1991), whereas the colony at the Gordon site in Sydney is atypical in being occupied throughout the year. A larger number of species can also be expected to be present in the Sydney region where urbanization has led to replacement of original forest with thousands of backyards and parks planted with a variety of species both exotic and native. *Eucalyptus ficifolia,* a summer blossoming species (Table 2), for example, is a Western Australian native widely planted in Sydney. While *Grevillea robusta,* which blossoms in spring, is a native from northern New South Wales that has been planted both in Sydney and Gosford and is readily eaten by flying-foxes (Fig. 3). In Gosford a large proportion of the original forest remains and remnants such as *Eucalyptus robusta*

Table 1. BATWATCH reports from the Gosford area of plants providing flying-foxes with food. (Non-native species are marked with an asterisk).

Family	Common name	Scientific name	Number of sightings
Blossom			
Agavaceae	Gymea Lily	*Doryanthes excelsa*	1
Arecaceae	Cabbage Tree Palm	*Livistona australis*	1
Avicenniaceae	Grey Mangrove	*Avicennia marina*	1
Fabaceae	*Coral Tree	*Erythrina* spp.	2
Malvaceae	Native Hibiscus	*Hibiscus* spp.	1
Myrtaceae	Myrtaceae		3
	Angophoras	*Angophora* spp.	3
	Sydney Red Gum	*A. costata*	2
	Rough-barked Apple	*A. floribunda*	1
	Eucalypt	*Eucalyptus* spp.	2
	Bangalay	*E. botryoides*	1
	Red Bloodwood	*E. gummifera*	3
	Spotted Gum	*E. maculata*	2
	Grey Ironbark	*E. paniculata*	2
	Blackbutt	*E. pilularis*	2
	Sydney Peppermint	*E. piperita*	1
	Swamp Mahogany	*E. robusta*	21
	Forest Red Gum	*E. tereticornis*	1
	Brush Box	*Lophostemon confertus*	1
	Turpentine	*Syncarpia glomulifera*	3
Proteaceae	Proteaceae		2
	Banksia	*Banksia* spp.	9
	Coastal Banksia	*B. integrifolia*	1
	Old Man Banksia	*B. serrata*	1
	Paperbark	*Melaleuca* spp.	1
	Broad-leaved Paperbark	*M. quinquenervia*	5
	Silky Oak	*Grevillea robusta*	1
Salicaceae	*Willow Catkins	*Salix* spp.	1
Fruit			
Arecaceae	Bangalow Palm	*Archontophoenix cunninghamiana*	1
Moraceae	Native Fig	*Ficus* spp.	11
	*Mulberry	*Morus nigra*	8
Musaceae	*Banana	*Musa* spp.	1
Myrtaceae	Lillipilli	*Acmena smithii*	1
	*Guava	*Psidium* spp.	3
Rosaceae	*Cotoneaster	*Cotoneaster* spp.	2
	*Apple	*Malus* spp.	3
	*Stone Fruit	*Prunus* spp.	2
	*Plum	*Prunus* spp.	3
	*Peach	*P. persica*	7
	*Nectarine	*Prunus* spp.	4
	*Apricot	*P. armeniaca*	1
Solanaceae	*Wild Tobacco	*Solanum mauritanian*	3
Urticaceae	Giant Stinging Tree	*Dendrocnide excelsa*	1
Vitaceae	*Grape	*Vitis* spp.	2
Other			
Fabaceae	**"Petioles"**		
	*Coral Tree	*Erythrina* spp.	1
Salicaceae	**Leaves**		2
	*Poplar	*Populus* spp.	1
	*Willow	*Salix* spp.	1

Table 2. BATWATCH reports from the Sydney area of plants providing flying-foxes with food. (Non-native species are marked with an asterisk).

Family	Common name	Scientific name	Number of sightings
Blossom			
Araliaceae	Umbrella Tree	*Schefflera actinophylla*	1
Fabaceae	*Coral Tree	*Erythrina* sp.	4
Lauraceae	*Advocado buds	*Persea americana*	1
Magnoliaceae	*Tuliptree	*Liriodendron tulipfera*	1
Mimosaceae	Queen Wattle	*Acacia decurrens*	1
Myrtaceae	Peppermint Tree	*Agonis flexuosa*	1
	Gum Tree		6
	Eucalypt	*Eucalyptus* sp.	9
	White Box	*E. albens*	2
	Lemon-scented Gum	*E. citriodora*	7
	Red-flowering Gum	*E. ficifolia*	2
	Flooded Gum	*E. grandis*	1
	Bloodwood		1
	Red Bloodwood	*E. gummifera*	1
	Spotted Gum	*E. maculata*	1
	Peppermint Gum	*E. nicholii*	1
	Red Mahogany	*E. resinifera*	1
	Swamp Mahogany	*E. robusta*	4
	Mugga Ironbark	*E. sideroxylon*	6
	Bottlebrush	*Callistemon* sp.	1
	Green Bottlebrush	*C. pinifolius*	1
	Paperbark	*Melaleuca* sp.	1
		M. quinquenervia	1
		M. styphelioides	1
	Turpentine	*Syncarpia glomulifera*	1
Proteaceae	Banksia	*Banksia* sp.	4
		Banksia integrifolia	1
		B. serratifolia	1
	Silky Oak	*Grevillea robusta*	24
	"Ivanhoe"	*Grevillea* sp.	1
	Wheel-of-Fire	*Stenocarpus sinuarus*	1
Rosaceae	*Loquat blossom	*Eriobotrya japonica*	1
	*Apricot blossom	*Prunus armeniaca*	1
Sterculiaceae	Illawarra Flame	*Brachychiton acerifolius*	2
Tamaricaceae	*Athel Pine	*Tamarix aphylla*	1
Fruit			
Anacardiaceae	*Peppercorn	*Schinus molle*	1
Arecaceae	Palm Tree fruit		4
	*Canary Island Date	*Phoenix canariensis*	3
	*Date	*Phoenix dactylifera*	1
Cucurbitaceae	*Chokos	*Sechium edule*	2
Moraceae	Native fig	*Ficus* sp.	46
	*Rubber Plant	*F. elastica*	1
	Weeping Fig	*F. macrocarpa* var. *hillii*	5
	Moreton Bay Fig	*F. macrophylla*	22
	Port Jackson Fig	*F. rubiginosa*	2
	Deciduous Fig	*F. superb* var. *henneana*	1
	*Mulberry	*Morus nigra*	14
Musaceae	*Banana	*Musa* sp.	1
Myrtaceae	Lillipilli	*Acmena smithii*	1
	*Guava	*Psidium* sp.	3
Oleaceae	*Olive	*Olea europea*	1
Pittosporaceae	Pittosporum seed	*Pittosporum undulatum*	1
Rhamnaceae	*Japanese Raisin	*Hovenia dulcis*	2

Table 2 — continued.

Family	Common name	Scientific name	Number of sightings
Rosaceae	*Loquat	*Eriobotrya japonica*	5
	*Apple	*Malus* sp.	2
	*Plum	*Prunus* sp.	5
Rosaceae	*Cherry Plum	*P. cerasifera*	1
	*Peach	*P. persica*	10
	*Apricot	*P. armeniaca*	2
Rutaceae	*Orange	*Citrus* sp.	1
	*Mandarin	*C. nobilis*	1
Vitaceae	*Grapes	*Vitis* sp.	3
Leaves			
Hamamelidaceae	*Liquidamber	*Liquidamber* sp.	1
Lauraceae	*Camphor Laurel	*Cinnamomum camphora*	1
Myrtaceae	Lillipilli	*Acmena smithii*	1
	Peppermint Gum	*Eucalyptus nicholii*	1
Salicaceae	*Poplar	*Poplus* sp.	4
Tamaricaceae	*Athel Pine	*Tamarix aphylla*	1

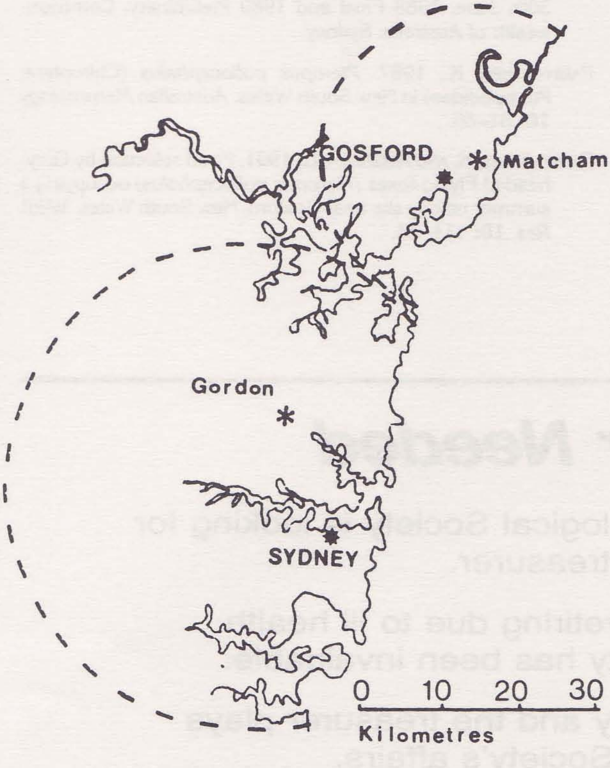


Fig. 2. Map of Sydney and Gosford areas showing the location of the Gordon and Matcham colony sites. Flying-fox sighting reports were allotted to the Sydney or Gosford area if they fell within the boundaries marked by the broken line.

are more likely to be mentioned in sighting reports than exotics. Finally, the differences between the two tables might also arise from sampling differences. Sydney with an average of 1 022 people per sq. km and a total area of 2 873 sq. km, simply has more observers in more places than Gosford, with an average of 123 people per sq. km and a total area of 1 028.19 sq. km (Australian Bureau of Statistics 1990). Species that appear ONLY in the Sydney list or, to a lesser extent, ONLY in the Gosford list are given in only one or two forms and hence are the subject of chance sightings.

Remains of insects, such as Christmas beetles, have been found in flying-fox droppings (Parry-Jones unpublished data), and one BATWATCH report from Gosford reported a flying-fox catching a cicada on the wing. The bat was almost certainly a *P. poliocephalus*.

Flying-foxes are able to use blossom, fruit, and leaf from a variety of native and introduced plants. The variety of species used is probably greater than listed in Tables 1 and 2 because the data are biased towards food supplies that are found close to human habitation and thus easily observed. Droppings analysed from various sites in New South Wales (Parry-Jones unpublished data; Parry Jones and Augee 1991) contain other species, particularly from rainforest pockets, that might constitute a large part of the flying-fox diet in the Sydney and Gosford areas from time to time. However, even if incomplete, the species lists from urban areas serve two major purposes. They indicate species that could be an important dietary component in other habitats and they

Fig. 3. Pteropus poliocephalus feeding in *Grevillea robusta*.

indicate species which, although are planted in urban areas to improve the environment for humans, are likely to have more and more importance for the survival of such flying-fox colonies as Gordon and Matcham as more and more eucalypt forest and rainforest resources are lost.

CONCLUSION

Conservation of flying-foxes is, to a large extent, linked to the conservation of their food resources. As forests have been felled over the last 200 years the flying-foxes have turned to a number of introduced food species and so have become urbanized animals. With increasing degradation of the native habitat it is possible that food supplies can be maintained within urban environments by the judicial planting of suitable food trees along the streets, in parks or in backyards. This can give the flying-foxes a steady year round food supply, a situation which appears to have accidently occurred in the Sydney area. The sightings of foraging flying-foxes in the Sydney and Gosford areas suggests some trees which could be considered for such planting.

ACKNOWLEDGEMENTS

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